and again, we did not suggest that the fast persists for so long as Kirkley implies.

An overriding impression one receives from this set of arguments is that much of our understanding of the migration strategy of Swainson's and Broad-winged Hawks remains conjectural. What is the appropriate lean body mass? How much pre-migratory fat is deposited? Do the hawks eat or drink *en route*? What is the physiological condition of the birds at different stages of migration? What were the historical evolutionary forces that promoted the strategy of mass migration? Kirkley has not provided data bearing on any of these points. We believe that the available data remain consistent with the hypothesis of a fasting migration for some substantial portion of the flight of Swainson's Hawks and Broad-winged Hawks. However, this certainly remains a hypothesis, and only data collected from pre-migratory and migratory birds will provide evidence for or against it.

RESUMEN.—Kirkley considera que los gavilanes de las especies *Buteo platypterus* y *B. swainsoni* no pueden llevar reserva de grasa, ni pueden tolerar la pérdida de agua para migrar en ayunas, como lo propone Smith et al. (1986), y que por tanto deben alimentarse. Sin embargo, la migración con vuelo de remonte obliga a estas aves a volar en grandes bandadas, lo que les limita el poder alimentarse. La aparente abundancia de alimentos disponibles para estas aves rapaces, excepto en condiciones de abundancia temporal, no ha sido observada. Consideramos que nuestras sugerencias, en cuanto a la migración en ayunas durante una distancia de 4000–5000 km y tal vez más, son razonables. Pese a la importancia de este tópico, aún no se tiene concreta información acerca de la reserva de grasa y agua en estas aves durante su migración.

LITERATURE CITED

ARAD, Z., I. GAVRIAELI-LEVIN, U. EYLATH AND J. MARDER. 1987. Effect of dehydration on cutaneous water evaporation in heat-exposed pigeons (*Columba livia*). *Phys. Zool.* 60:623–630.

BARTHOLOMEW, G.A. 1972. The water economy of seed-eating birds that survive without drinking. Proc. 15th Int. Ornithol. Congr., pages 237–254.

CHEREL, Y., J.-P. ROBIN AND Y. LEMAHO. 1988. Physiology and biochemistry of long-term fasting in birds. *Can. J. Zool.* 66:159–166.

LASIEWSKI, R.C., A.L. ACOSTA AND M.H. BERNSTEIN. 1966. Evaporative water loss in birds—I. Characteristics of the open flow method of determination, and their relation to estimates of thermoregulatory ability. *Comp. Biochem. Physiol.* 19:445–457.

SMITH, N.G. 1980. Hawk and vulture migrations in the Neotropics. Pages 51–65 *in* A. Keast and E.S. Morton [EDS.], Migrant birds in the Neotropics: ecology, behavior, distribution and conservation. Smithsonian Inst. Press, Washington, DC.

———. 1985. Some uncertain aspects of migration by Swainson's Hawks (*Buteo swainsoni*) and Turkey Vultures (*Cathartes aura*). Proc. North American Hawk Migration Conf., Rochester, New York.

———, D.L. GOLDSTEIN AND G.A. BARTHOLOMEW. 1986. Is long-distance migration possible for soaring hawks using only stored fat? *Auk* 103:607–611.

WEBSTER, M.D. AND J.R. KING. 1987. Temperature and humidity dynamics of cutaneous and respiratory evaporation in pigeons, *Columba livia*. *J. Comp. Phys.* 157:253–260.

Received 18 March 1991; accepted 2 April 1991

J. Raptor Res. 25(3):88–89

THREE POSSIBLE NEST-RELIEF FACTORS IN THE AMERICAN KESTREL (*Falco sparverius*)

JUAN ESTEBAN MARTÍNEZ-GÓMEZ
Av. 16 de Septiembre 1758, Veracruz, Veracruz 91900, Mexico

Balgooyen (1976) reported that male American Kestrels during incubation typically visited nests twice a day, once in the morning and once in the afternoon, and suggested that the male seemed to dictate the time of nest-relief. Olendorff (1968) could not predict nest-relief in kestrels because most of the times when the male presented himself, the female did not come out of the nest box. Although I noted a pattern of nest-relief behavior similar to that described by both Roest (1957) and Balgooyen (1976), I twice saw a female replace the male by entering the cavity. Here I report some cues that may influence nest-relief behavior in kestrels.

Table 1. Number of instances of incubating kestrels according to time of day in central Wisconsin, 1990. Sample sizes are in parentheses.

H	Number of Females (71)	Number of Males (40)	Total (111)
0301–0330	1	0	1
0331–0400	1	0	1
0401–0430	0	0	0
0431–0500	2	1	3
0501–0530	1	0	1
0531–0600	6	5	11
0601–0630	1	9	10
0631–0700	11	3	14
0701–0730	3	5	8
0731–0800	11	1	12
0801–0830	3	0	3
0831–0900	4	2	6
0901–0930	4	0	4
0931–1000	1	0	1
...			
1201–1230	0	1	1
1231–1300	0	0	0
1301–1330	1	0	1
1331–1400	0	1	1
1401–1430	1	0	1
1431–1500	3	4	7
1501–1530	6	2	8
1531–1600	3	6	9
1601–1630	4	0	4
1631–1700	2	0	2
1701–1730	1	0	1
1731–1800	0	0	0
1801–1830	1	0	1

During the 1990 breeding season on the Buena Vista Marsh in Portage County, Wisconsin, I noticed that on 14, 17 and 20 May, eight male American Kestrels (three, two and three, respectively) were incubating at almost the same time, 0600 H. Wilmers et al. (1985) found in West Virginia and Pennsylvania males incubating principally ≤2.8 hr before sunset, but in Quebec males were incubating "more uniformly among several periods." From 30 April to 15 June I frequently found males incubating at about 0600 H and 1500 H during weekly visits to 21 occupied nest boxes in the study area (Table 1). I found males in 40 of 111 checks (36%); 17 were in the first 10 days after the clutch was completed, 8 in the second 10 days, 13 in the third 10 days, and only 2 after the 30th day, but this could be a bias due to the timing of sampling.

From 17 May to 21 June, I watched 8 pairs of kestrels from 0500 to 0700 H and from 1400 to 1600 H in 31 sessions, totaling 62 hr of observation. In 12 instances the male took his place in the box during the session, in 6 the male had done so before the session, and in 13, I saw no nest-relief. Thus, in 52% of the sessions I found males incubating. Males took their place in the nest box in 16 of 20 sessions (80%) when the sun was visible. In contrast, they did so in only 2 of 11 sessions (18%) on heavily overcast days. Balgooyen (1976) found "that temperatures above 21°C allow a rather lax rate of nest-relief but exchange is prompt at temperatures below 10°C." My field notes show that nest-relief occurred in 11 of 18 sessions (61%) with temperatures below 21°C and in 7 of 13 sessions (53%) with temperatures above 21°C. Although I watched pairs in a similar stage of incubation certain pairs of birds were more predictable than others in their patterns of nest-relief.

RESUMEN.—Se reporta una notable incidencia de Halcones Cernícalo macho (*Falco sparverius*) incubando alrededor de las 0700 H y las 1500 H; así como la posible influencia de la temperatura e iluminación ambientales, y el estadio de incubación en este fenómeno.

ACKNOWLEDGMENTS

I am grateful to Frances Hamerstrom and Annie Wendt for their advice.

LITERATURE CITED

BALGOOYEN, T.G. 1976. Behavior and ecology of the American Kestrel (*Falco sparverius*) in the Sierra Nevada of California. *Univ. Calif. Publ. Zool.* 103:1–87.

OLENDORFF, R.R. 1968. A contribution to the breeding behavior of the American Kestrel in captivity. *Raptor Res. News* 2(4):77–92.

ROEST, A.I. 1957. Notes on the American sparrow hawk. *Auk* 74:1–19.

WILMERS, T.J., R. BOWMAN AND D.E. SAMUEL. 1985 Notes on incubation by male kestrels in West Virginia, Pennsylvania, and Southern Quebec. *N. Amer. Bird Band.* 10(1):6–8.

Received 21 August 1990; accepted 16 November 1990